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DISEASES OF COTTON PLANTS IN INDIA

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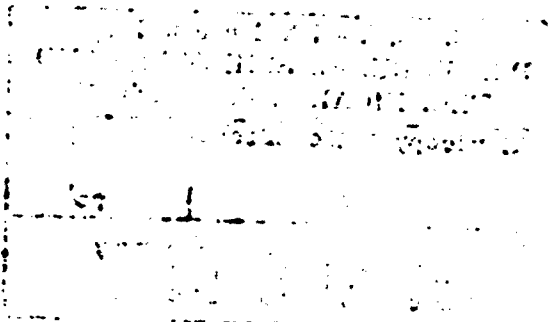
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DISEASES OF COTTON PLANTS IN INDIA

Following is the translation of an article by Ye. V. Shver, Master of Agricultural Sciences, appearing in the Russian-language periodical Zashchita Rasteniy ot Vrediteley i Bolezney (Protection of Plants from Pests and Diseases), No 7, 1964, pages 45--48. Translation performed by Sp/7 Charles T. Ostertag Jr. 7

Cotton is one of the main agricultural crops in India. More than 8 million hectares of cotton are sown yearly. Mainly three species of cotton are cultivated: Gossypium arboreum, G. herbaceum and G. hirsutum; the first of these is the most widely distributed.

In the past in this country, varieties with a coarse and short fiber were grown primarily. When India obtained independence, a great deal of attention was given to selection work, and now 65 institutes and test stations are engaged in finding sorts of cotton plants. As a result, already in 1958--1959, 84% of the sown areas was taken up with long and average fiber sorts.

Up until now, in spite of a certain progress in the development of the cotton industry, the harvests of crop in India remain the lowest in the World. For example, in 1958--1959 on the area of 8 million hectares no more than 3 centners of cotton wool was obtained from each hectare. One of the reasons for such a low productivity is the considerable loss, inflicted by pests and diseases, which reaches 100 million rupees annually.

For a period of three years (1957--1960), the author of this article worked in India and visited many cotton growing states. The article contains, along with data from the literature, personal field observations and an acquaintance with scientific research projects on diseases of cotton plants in the states of Bombay, Madras, Andhra, Madhya Pradesh, Rajasthan and Punjab.

Around 20 diseases, caused by fungi, bacteria, viruses and nematodes, have been recorded on the young cotton plants in India. Fungous diseases represent the most extensive group. It includes Fusarium wilt, root rot, anthracnose, rust, powdery mildew, gray and cercospora blight of leaves, alternariosis, helminthosporiosis, seedling blight, sooty mold, southern sclerotium rot, and various boll rots. Of the bacterial diseases, gummosis is circulated, and of the viral diseases -- stenosis. Nematodes cause knottiness of the roots of cotton plants. Fusarium wilt, root rot, anthracnose and gummosis are considered most harmful.

Fusarium wilt, caused by the fungus *Fusarium oxysporum* f. *vasinfectum*, is distributed in the states of Bombay, Madras, Andhra and Madhya Pradesh. The total losses caused by this disease have not been reported.

However, it has been established that prior to the uncovering of resistant sorts it reached 40--60% in some regions, and according to the calculations of Ya. S. Kulkarni, in the state of Bombay alone no less than 50% of the harvest of cotton plants were lost from this disease. *Fusarium* affects *G. arboreum* and *G. herbaceum*; the symptoms of the disease are the usual ones. It has not been noted on the species *G. hirsutum* and *G. barbadense*.

The country's research institutes have developed sorts that are resistant to *Fusarium* wilt: Jayawant, Jayadhar, Jarila, B. D. 8, Vijay, Verum, Suyog, Vihalpa, Vernar Gaoran 6--E and others, as a result of which losses from wilt have been reduced considerably.

Root rot mainly affects the cotton plants in the alluvial soils of the states of Punjab, Rajasthan and Gujarat, and to a lesser degree in the black soils of central India. The fungus *Macrophomina phaseoli* (M) Ashby is considered the main causative agent. On the irrigated soils of Punjab the disease usually appears in June on 6-week old plants and develops intensively for the next two weeks. The plants suddenly wilt and then die. In August the number of sick plants decreases, and in September there are none at all.

In Gujarat and Uttar Pradesh, root rot is noted on full grown plants during flowering and fruit formation. In this case, besides the rotting of the root system, the leaves turn yellow and the bolls fall off. The plants are easily pulled out of the soil and the sclerotia of the fungus *Sclerotium bataticola* Taub, are noted on the roots.

Root rot is one of the most harmful diseases of the cotton plant. Losses in harvest due to it in the country comprise 2--5%, and in some fields it reaches 60%. It has been established by the investigations of Indian phytopathologists that with mixed plantings of the cotton plant with *Phaseolus aconitifolius* and *Andropogon Sorghum* the harmful effect of fungi, the causative agents of root rot, decreases thanks to the darkening from the young covering crop and a lowering of the soil temperature. Another means of lowering the amount of loss from the disease is the planting of cotton plants in earlier or later periods.

In central India wet rot of the cotton plant has been recorded. It is caused by the fungi *Phytophthora parasitica* Dastur and *Phthium* spp. Irregular watery spots appear on the cotyledons and the first true leaves. The affected organs lose chlorophyll and become grayish, and the main fibers -- brown. The oldest spots are surrounded by a yellowish-green ring, which gradually blends with the healthy green color of the leaf. Often several spots appear on one leaf. When it is strongly developed the disease spreads to the peduncles, as a result of which the leaves droop and fall off. In the event the growing point is affected the plants die. Wet root rot is caused by heavy humidity.

Anthrachnose inflicts great harm to the cotton plant in the region of Eastern Kandesh (state of Bombay), where in July-October 1958 a strong outbreak was noted. This was promoted by abundant precipitation. Also speaking for the direct tie between the affection of cotton plants with anthracnose and the amount of precipitation are the observations of the Indian phytopathologist D. F. Dastur and the American investigators A. Smith, D. Neal and D. G. Dickson. The latter report that in the USA the disease is distributed in the cotton growing states located to the east from the zone of natural wetting with an annual precipitation of 1,000 mm along the coast of the Atlantic Ocean and the Gulf of Mexico. The data presented makes it possible to assume that the development of anthracnose on the cotton plants in the cotton growing regions of the USSR, where considerably less precipitation falls, is little probable.

Seedlings, bracts, bolls and the fiber are affected by the disease. Reddish-brown spots appear on the stem. These girdle the stems and usually the plants die. On the bracts the spots are watery and spherical, either brown or black. They enlarge rapidly and may cover the boll. The latter, if its base is affected, falls off. The first symptoms on the bolls appear in the form of small, spherical, reddish or reddish-brown spots which are slightly depressed in the center. When the spots enlarge the central part becomes black and the edges remain reddish. In humid weather the center of the spot is covered by the orange-rose fruiting of the fungus. Affected fiber turns a black color. Strongly affected seeds have a yellow-brown color and are much smaller than healthy ones. Such seeds, as a rule, do not germinate, but sometimes yield sprouts in which the point of growth is finally affected and the plants die.

The causative agent of anthracnose is considered the imperfect fungus Colletotrichum indicum Dastur., which is somewhat different from the causative agent of an analogous disease in the USA. In the first place, the ascomycetous stage has not been detected on the fungus in India. Secondly, its conidia are crescent-shaped, while in the USA they are cylindrical, and in the third place the Indian form affects only the local Asian cotton and does not affect G. hirsutum and G. barbadence. The fungus is preserved from year to year in the seeds of the cotton plant and in the soil on vegetative remnants. Indian phytopathologists recommend that the seeds be disinfected and the post-harvest remnants be destroyed. Based on the data of V. P. Bkhide, M. K. Desai and M. S. Reyna, for the treatment of cotton seeds in 1956--1957, mercuric preparations of agrozan and tserezan were used on the basis of 8.3 kg for 1 t of seeds. These seeds were sown in the state of Bombay in the regions of Nazik and Kandesh over an area of 1200 hectares. The affection of shoots of the Vernar sort, which is strongly sensitive to anthracnose, fluctuated from 0.05% to 3.8%, and in the control from 3.2 up to 12.5%. For combatting secondary anthracnose infection it is recommended to use a double spraying of the shoots with Bordeaux mixture and a single treatment with the same preparation when the disease first appears.

Gummosis (Xanthomonas malvacearum E. F. S.) affects the sort of American origin and the Indo-American hybrids. The local Asiatic cottons are mildly sensitive to the disease and some of them are not sensitive at all. Gummosis inflicts great harm in the South of the country, particularly in the state of Madras and in some regions of the state of Bombay. For combatting it they make use of treatment of the seeds with mercuric-organic preparations, and in some places, defibrating the seeds with sulfuric acid.

Powdery mildew, the causative agent of which is the fungus Oidium cerneum Cke., is encountered from time to time in the state of Madras. Only old leaves are affected, and yellow or red spots form on them. Then the disease embraces the entire surface of the lamina, and the lower side is covered with the white shiny mycelium. Only the conidial stages of the fungus are recorded in India. In the event of a strong affection it is recommended to treat the young crops with sulfur.

Rust (Cerotelium desmium Arth.). There is information concerning this disease on foreign and perennial arborescent cotton plants in the state of Madras. Mainly the leaves are affected. Small, purple-brown spots are noted on their upper side. Such leaves fall off prematurely. Uredo- and telio- stages are noted, but the spores of the latter do not mature.

Gray blight of leaves (Rumularia oreola Atk.). This has been recorded in India only in the eastern part of the state of Madras (on the coast) and in the state of Bombay. The disease mainly affects the leaves of adult plants, on which angular, transparent, whitish spots, limited by veins are formed. With time, the leaf tissue becomes yellowish-brown and the lower surface of the leaves is covered with a whitish conidial film, which then appears on the upper side also. It is considered that the disease does not bear any essential harm, therefore, there are no recommendations for combatting it. However, based on our observations, in the regions of Dzhalgaoon and Nagpur (state of Bombay) the disease has been noted in a more harmful form in recent years.

Cercospora blight of leaves (Cercospora gossypina Coocoe) affects cotton plants in several sectors of India. Spherical or irregular shaped spots are noted on the leaves. Initially they are of a yellowish-brown color, and then the center of the spot becomes white with a dark brown rim. Several such spots may be joined together, causing the wilting of a large portion of the lamina. The perfect stage of the fungus Mycospharella gossypii Ear. has not been detected in India. Old leaves are affected most often of all, while the young leaves are affected only under conditions unfavorable for the growing of the cotton plant.

Stenosis. The disease was first detected in 1930 in the state of Punjab, and then in Bombay and Madras. In the western part of India it strongly affects the cotton plant G. herbaceum, but it may also affect

other species, except G. barbadence.

This disease of viral origin usually begins on plants of a 2--3 month growth, and is characterized by the interruption of growth of the above ground parts. It decreases the lobules of the leaf quantitatively, and the stipules are normal but very light. A large portion of the buds and young bolls drop off and the plants die in 2--3 months. There are reports that the disease is not transmitted through the seeds.

Alternariosis (Alternaria macrospora Z.) was first detected on G. hirsutum in Hardwar, Pun, Ahmadnagar and Deccan. Arborescent cotton plants are affected especially strongly.

The disease appears on the leaves in the form of small, spherical or irregular, pale or dark brown, spots, protuberant from the upper side and concave from the lower side. When the disease is developed strongly the spots unite and both surfaces of the leaf are covered with a dark brown film. The leaves and the bolls wither and drop off, and the stem splits vertically. The disease is recorded in August and September, when the humidity is high and the temperature moderate.

Helminthosporiosis, caused by the fungus Helminthosporium gossypii Fur., was noted in a severe form on the cotton plant G. hirsutum in December 1951 in Dzhavar (state of Mysore). The disease mainly affected the leaves and bracts, on which circular, light-brown, spots 0.5--2.5 mm in size appeared. Then the spots became ashen in the center with a dark-purple edge. With time, the central part of the spot fell out and the leaves appeared perforated. The fungus-causative agent spends the winter on affected leaves.

Seedling blight, caused by the fungus Pellicularia filamentosa (Pat.) Roge, was recorded in the state of Madras. The seedlings died, as a result of which large bare places were observed in the fields. In addition to the cotton plant, the disease affects beets, Lactu lettuce, onions, garden radishes, turnips, cabbage, peas, beans, alfalfa, flax, potatoes, tomatoes and grain crops. The fungus is probably preserved in the soil and on the seeds.

Southern sclerotium rot (Sclerotium Rolfsii Sacc) causes a disease on cotton plants which is known under the name of sclerotium wilt. The disease was first detected in 1931 in the state of Bombay, and then in the central provinces of the country. It affects the cotton plants only during years with severe rains and is therefore not considered very harmful.

Knottiness of the roots, according to the report of B. N. Uppal, was detected in the north of India in the state of Panjab on local sorts of the cotton plant. On the tap root and the lateral roots (and sometimes inside of the first one), swellings or knots are formed. These contain a great quantity of nematodes which apparently belong to Anguillulira pratensis (a species which has been recorded on other crops in India). Plants which

are affected weakly with knottiness appear as usual, but if the disease is severe they cease growing and the leaves lose their chlorophyl.

Sooty mold is caused by a fungus of the *Capnodium* spp. It covers the leaves and bolls with a brown or black film.

Boll rot is a disease caused by the fungi *Aspergillus niger* Fiegh and *Nematospora naggur*. Dast.